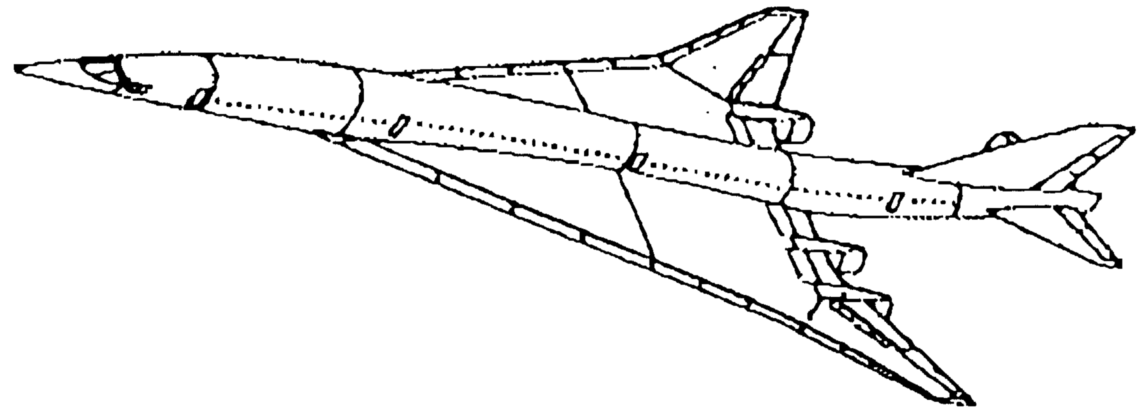
N94- 33448

NASA
National Aeronautics and
Space Administration



First Annual HSR Program Workshop

Headquarters Perspective

51-05
12016

Office of
Aeronautics
Exploration and
Technology

Robert E. Anderson
Assistant Director for Aeronautics

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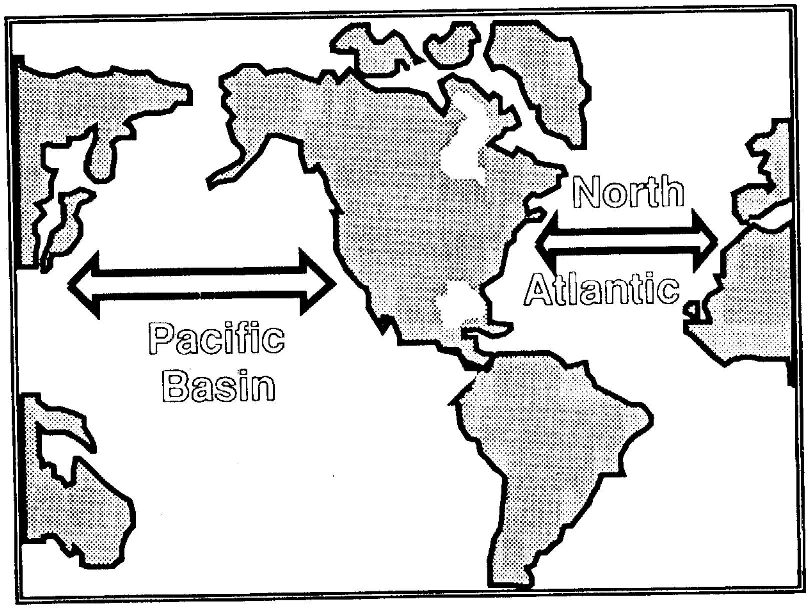
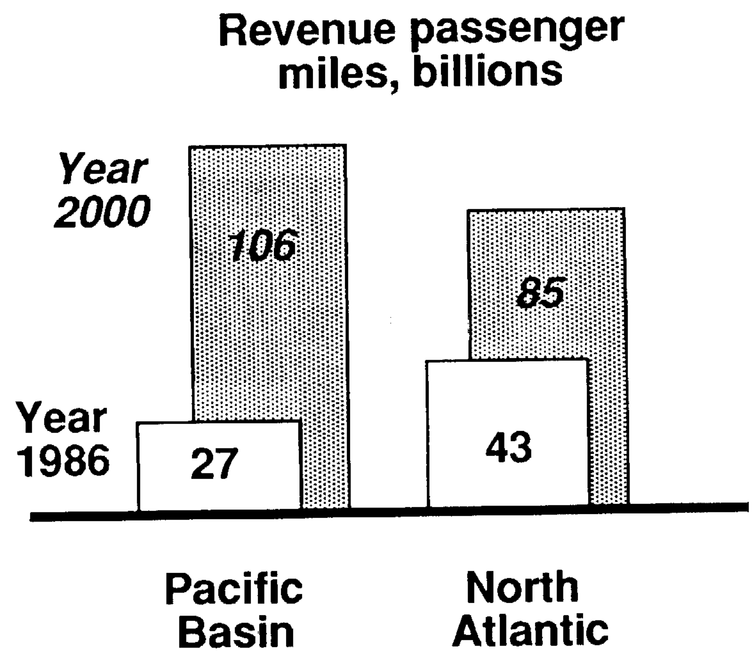
OVERVIEW

- NATIONAL CHALLENGE
- PROGRAM GENESIS & STRUCTURE
- WORKSHOP OBJECTIVES

HIGH-SPEED TRANSPORT MARKET



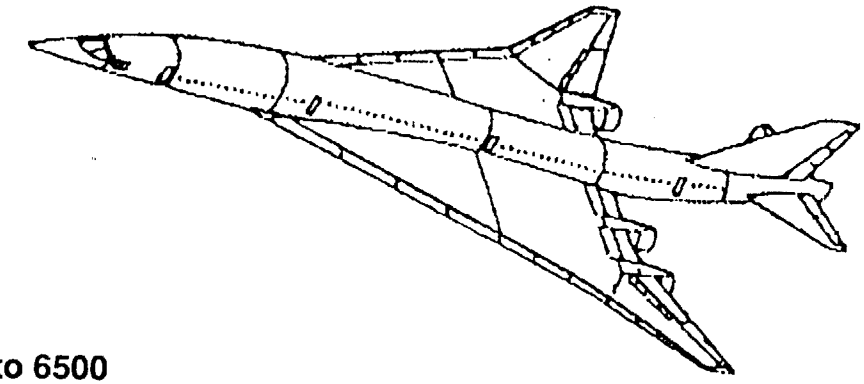


300,000 HSCT passengers per day possible in year 2000

Supersonic Transport Challenge

Keys to Success

- Environmentally acceptable
- Technically feasible
- Economically viable



Goals

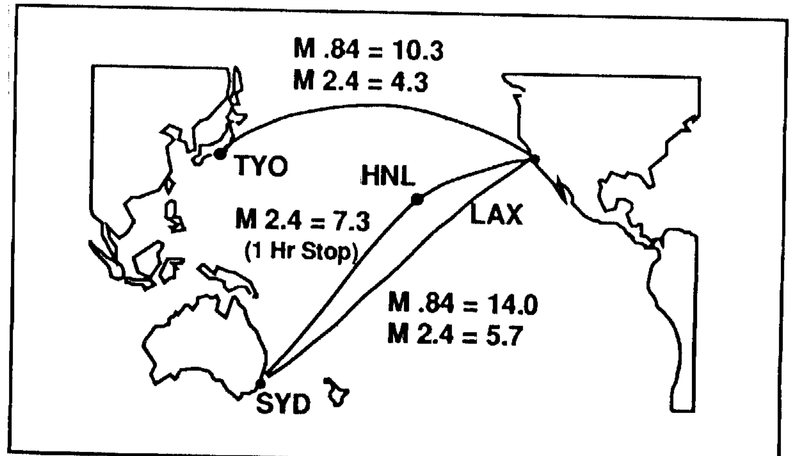
- Introduction: 2005
- Speed: Mach 2.4
- 250-300 passengers
- Range: 5000 nautical miles; growth to 6500
- Fare level: near current market

Comparative Perspective

	Concorde	U.S. SST	HSCT
Market	North Atlantic	North Atlantic	Atlantic and Pacific
Range (nmi)	3000	3000	5000-6500
Payload (pass)	103	200	250-300
TOGW (lb)	400,000	650,000	700,000
Community Noise standard	(waiver)	Stage 2	Stage 3
foot print (sq mi)	75	50	5-6
Revenue req'd (cents/RPM)	87	60+	10 (goal)

Example Trip Times

Hours



NATIONAL CHALLENGE

- Long distance air travel is a large and rapidly growing market
- HSCT represents the next plateau in an aggressive international aviation competition
- Major technological uncertainties remain, acting as barriers to successful HSCT introduction
- NASA has a strong capability, and a critical national role, in the high-speed arena

NASA'S AERONAUTICS R&T CORNERSTONE FOR THE 1990'S


NATIONAL AERONAUTICAL R&D GOALS
TECHNOLOGY FOR AMERICA'S FUTURE
NATIONAL AERONAUTICAL R&D GOALS
AGENDA FOR ACHIEVEMENT
Executive Office of the President
Office of Science and Technology Policy

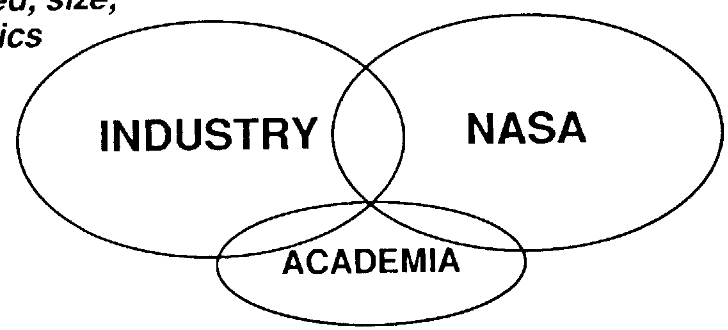
Agenda for Achievement

Action Plan Recommendations

"Industry provide strong, creative leadership. A high-speed transport will probably require pooled resources..."

"Industry analyze the market needs for an advanced high-speed transport and identify the economic, speed, size, range and fuel characteristics necessary..."

"Industry and NASA determine the most attractive technical concepts and the necessary technology developments..."

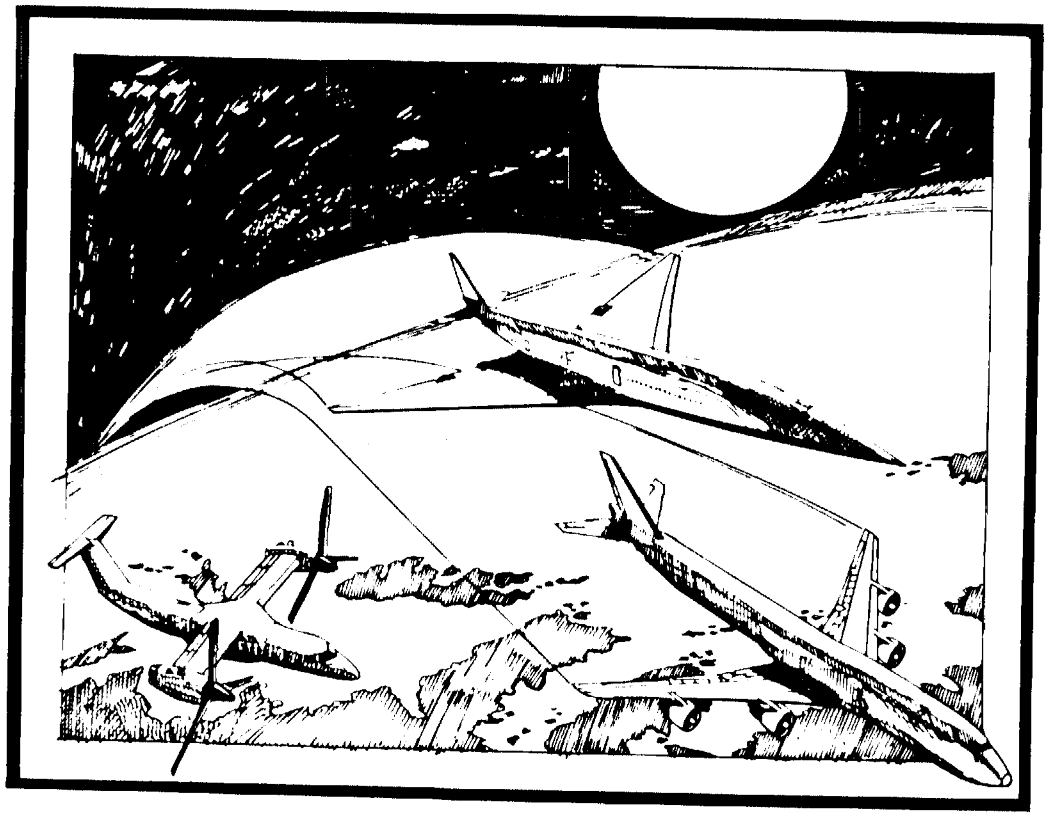


"Government and industry determine the necessary characteristics for environmental compatibility."

"NASA, industry and academia begin a focussed and coordinated approach to ready required technology for U.S. industry development and application."

Develop fundamental technology, design, and business foundation for a long-range, supersonic transport in preparation for a U.S. industry initiative.

CIVIL AERONAUTICS TECHNOLOGY DEVELOPMENT AND VALIDATION PLAN



Office of
Aeronautics and
Space
Technology

MARCH 1988

RJ88-383(1)

CIVIL AERONAUTICS
TECHNOLOGY DEVELOPMENT & VALIDATION PLAN

"NASA IS DIRECTED TO PREPARE A MULTI-YEAR TECHNOLOGY DEVELOPMENT VALIDATION PLAN THAT WILL HELP THE UNITED STATES RETAIN ITS LEADERSHIP IN AERONAUTICS RESEARCH AND TECHNOLOGY AND COMPETE IN THE INTERNATIONAL MARKETPLACE FOR FUTURE CIVIL AIRCRAFT. THIS PLAN SHALL BE PREPARED IN COOPERATION WITH PRIVATE INDUSTRY AND SHALL BE DESIGNED TO ASSURE CONTINUED U.S. LEADERSHIP IN FUTURE CIVIL AIRCRAFT MARKETS. THIS PLAN SHOULD BE SUBMITTED TO THE COMMITTEE BY MARCH 1, 1988."

NASA AUTHORIZATION ACT, 1988

SENATE COMMITTEE ON COMMERCE,
SCIENCE AND TRANSPORTATION

JUNE 24, 1987

AERONAUTICS STRATEGIC THRUSTS

OAET

- **SUBSONIC AIRCRAFT/NATIONAL AIRSPACE**
  Develop selected, high-leverage technologies and explore new means to ensure the competitiveness of U.S. subsonic aircraft and to enhance the safety and productivity of the National Aviation System

- **HIGH-SPEED AIR TRANSPORTATION**
  Resolve the critical environmental issues and establish the technology foundation for economical, high-speed air transportation

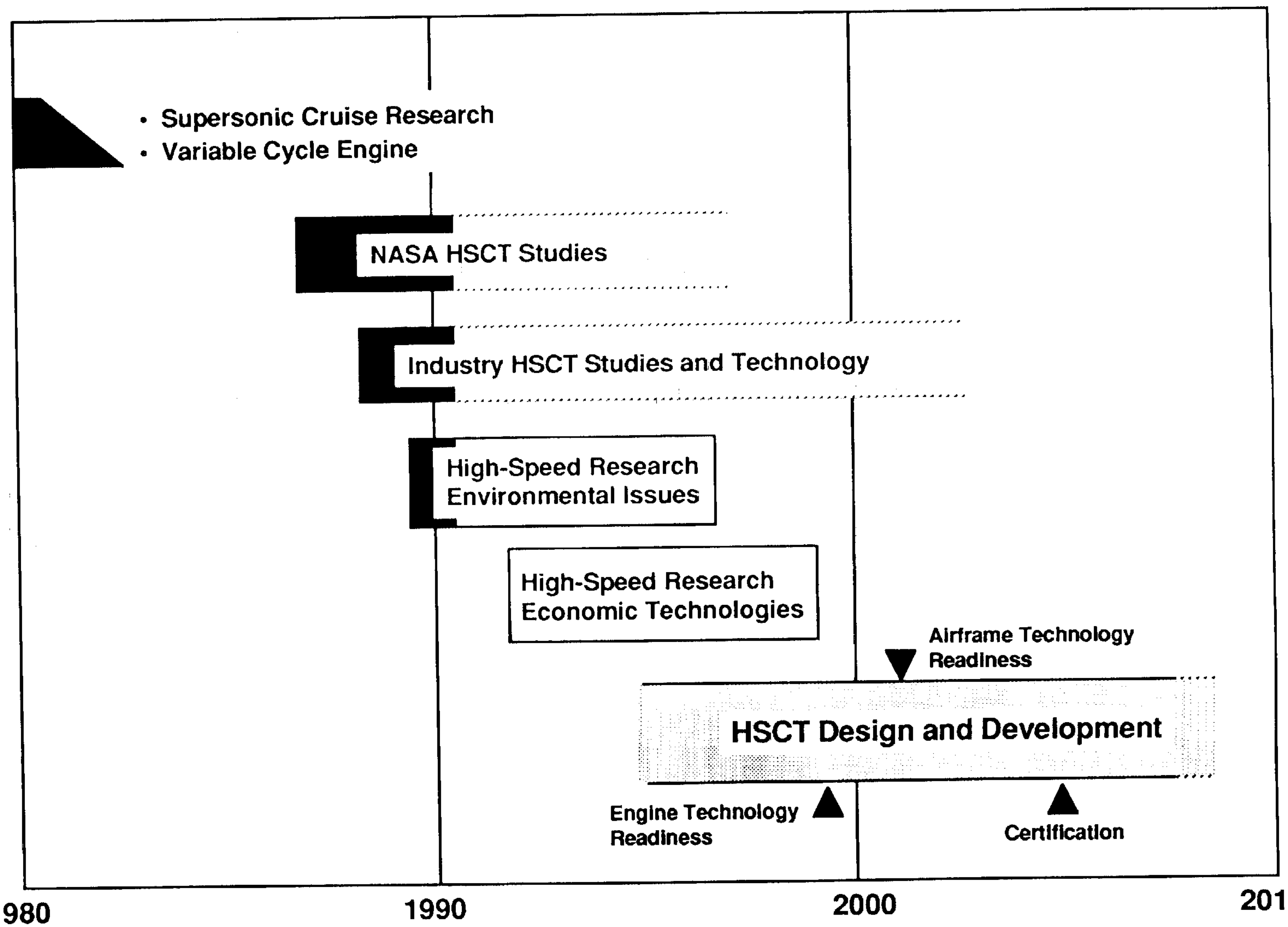
- **HIGH-PERFORMANCE MILITARY AIRCRAFT**
  Ready technology options for revolutionary new capabilities in future high performance fixed and rotary wing aircraft

- **HYPERSONIC/TRANSATMOSPHERIC VEHICLES**
  Develop critical technologies to support ground and flight demonstration of the X-30 National Aero-Space Plane and the development of future hypersonic vehicles

- **CRITICAL DISCIPLINES**
  Pioneer fundamental research, cross-cutting technology development, and validation of numerical simulation techniques to maintain the theoretical, experimental, and predictive foundation required for the design and operation of advanced aerospace systems

- **NATIONAL FACILITIES**
  Develop, maintain, and operate critical national facilities for aeronautical research and for support of industry, DoD, and other NASA programs

SECOND GENERATION HSCT APPROACH



HIGH-SPEED AIR TRANSPORTATION

Resolve the critical environmental issues and establish the technology foundation for economical, high-speed air transportation

- BY 1995, RESOLVE THE ENVIRONMENTAL ISSUES OF ATMOSPHERIC IMPACT, AIRPORT NOISE AND SONIC BOOM

  - Develop low-emission combustor technology & atmospheric models leading to acceptable fleet impact assessments

  - Develop source noise reduction, high-lift technologies and operational procedures leading to aircraft noise impact consistent with FAR 36 - Stage 3

  - Develop low-boom aircraft configurations and define viability of supersonic over-land flight

PHASE I EARLY RESULTS

START

FY 1990	FY 1991	FY 1992	FY 1993	FY 1994	FY1995
ANALYSIS & LAB FEASIBILITY		CONCEPT EVALUATION.		TECHNOLOGY VERIFICATION	

COMPLETION

<u>EMISSIONS</u>

PROMISING ATMOSPHERIC MODEL RESULTS INDICATING POTENTIAL ACCEPTABILITY OF TARGET EMISSION LEVELS

- Less than 1% ozone depletion for mature HSCT fleet

FLAME TUBE NOx FORMATION AND CONTROL DEMONSTRATION

- < 5 grams / Kg NOx measured under simulated operating conditions

<u>NOISE</u>

SCALE-MODEL NOZZLE ACOUSTICS DEMONSTRATION

- > 15 EPNdB measured noise reduction

READINESS FOR INITIATION OF PHASE II TECHNOLOGY DEVELOPMENT PROGRAM

HIGH-SPEED AIR TRANSPORTATION

Resolve the critical environmental issues and establish the technology foundation for economical, high-speed air transportation

- BY 1998, DEVELOP AND VERIFY, IN COOPERATION WITH U.S. INDUSTRY, THE HIGH-LEVERAGE TECHNOLOGIES ESSENTIAL FOR ECONOMIC VIABILITY

  - Develop enabling propulsion materials & critical adv. propulsion components, and demonstrate their integration in technology test beds

  - Develop advanced wing aerodynamic configurations providing increased transonic & supersonic L/D, and demonstrate low-speed, high-lift system & propulsion system integration

  - Develop light-weight, high-temperature airframe materials & structural concepts, and demonstrate large component fabrication & durability

  - Develop & demonstrate integrated controls & low-visibility flight deck technologies critical to efficient international airspace system operation

  - *Assess airframe, propulsion and fight deck technologies for their impact on high-speed civil transport environmental acceptance and economic viability*

HIGH-SPEED RESEARCH PHASE II

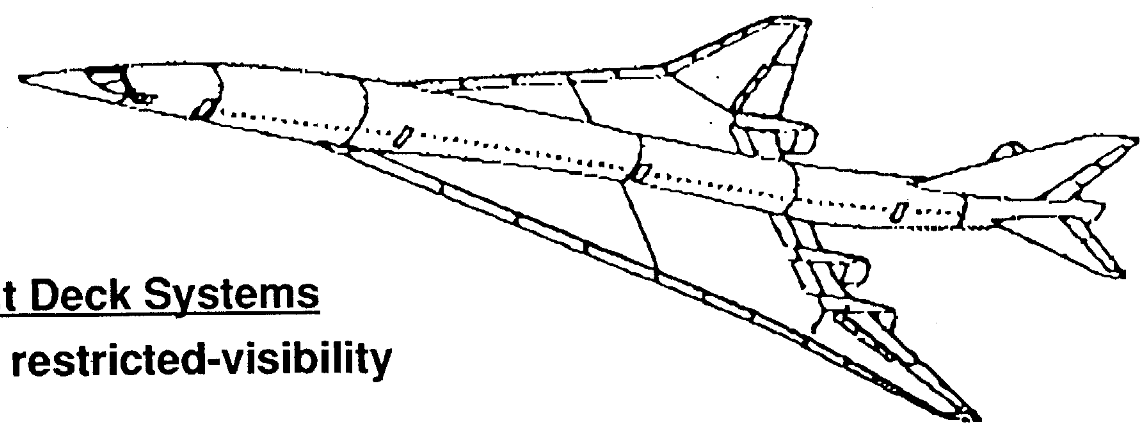
OAET

Airframe

- Airframe materials & structures technology
- Aerodynamic performance & integration

Propulsion

- Critical propulsion components
- *Enabling Propulsion Materials*
- Propulsion system demonstration



Flight Deck Systems

- Advanced, restricted-visibility cockpit

HSR PROGRAM PRIORITY

A SUCCESSFUL SST WILL PERMIT LITTLE ROOM FOR DESIGN COMPROMISES

"Past experience indicates that there will be little room for design compromises in the development of a successful SST. To meet the stringent environmental constraints of noise, sonic boom, and pollution in a safe, economically competitive SST will require the best possible combination of aerodynamic, structural, and propulsion technologies. Isolated advances in the disciplinary technologies are meaningless unless they can be integrated into a congruent airplane that meets all mission requirements."

F. EDWARD McLEAN, "SUPERSONIC CRUISE TECHNOLOGY,: NASA SP-472, 1985, P. 6

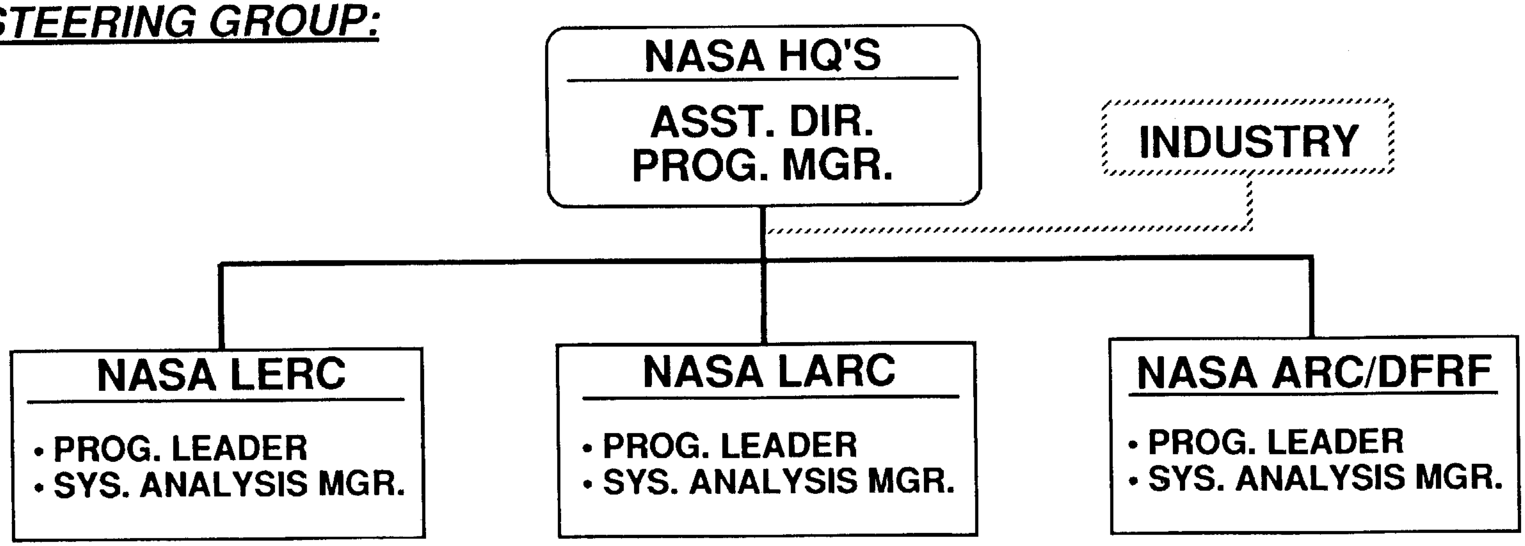
AN INTEGRATED NATIONAL TECHNOLOGY PLAN IS CRITICAL TO SUCCESS

INTEGRATED NASA/INDUSTRY HSR PLAN

OBJECTIVE:

- ESTABLISH UNIFIED FRAMEWORK BETWEEN NASA AND INDUSTRY FOR COORDINATED PURSUIT OF HSCT DEVELOPMENT
  - Develop technology priorities, critical path and schedules
  - Enhance communication between performing organizations (NASA, industry & academia)
  - Assess progress in discipline areas from system perspective to ensure high-payoff & timely technology deliverables

STEERING GROUP:



NASA AERONAUTICS R&D BUDGET

($,M)

	1992	1993	1994	1995	1996	1997
CONGRESSIONAL SUBMITTAL (FY 1992)	591.2	670.5	716.0	742.6	672.2	687.9
HSR PHASE I	(76.4)	(89.9)	(90.4)	(70.9)	(11.0)	-
Environmental	(59.9)	(57.9)	(49.9)	(46.9)	(-0.-)	
Enabling Prop. Mat'ls	*(16.5)*	*(32.0)*	*(40.5)*	*(24.0)*	*(11.0)*	*(-0.-)*
HSR PHASE II		?	?	?	?	?

WORKSHOP OBJECTIVES

- COMMUNICATE OBJECTIVES AND PROGRESS TO ALL PROGRAM PARTICIPANTS
- REVIEW AND DISCUSS FUTURE EFFORTS AND PLANS

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